Problems of Machine Picking

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Power machines have lowered the cost of producing cotton, but they have also created new problems at the gin and the textile mill.

Machine-picked cotton contains extra moisture from the spindles and considerably more than the usual 5 to 15 percent of trash present in hand-picked cotton; particularly bothersome is leaf material, one of the most difficult types of trash to remove.

The additional moisture and trash in machine-harvested cotton frequently complicate ginning and raise the costs of textile manufacture by calling for extra cleaning steps at the mill. Yet the industry recognizes that mechanical harvesting is an essential step in the mechanization of cotton production to reduce over-all costs to levels comparable with those of synthetic textile fibers.

The actual percentage of the total American cotton crop picked by machines is small. The National Cotton Council put it at 16 percent for the 1950 crop. On the basis of a total crop of nearly 10 million bales, that means that about 1.6 million bales of machine-picked cotton were available. The significant fact is that this number is an increase of 75 percent over the 1949 estimate. The limiting factor in mechanical harvesting has been not so much the unwillingness of cotton farmers to use mechanized equipment as it has been the lack of machines. With availability of machines and mechanical improvements a certainty, machine-picked cotton is bound to be reckoned with more and more as time goes on.

MACHINES USED to harvest cotton are of two general types—spindle pickers and strippers. Varying designs of each are on the market.

The present spindle picker was evolved from a machine believed to have been first patented in 1850. Today's models are high-wheeled motorized vehicles, which straddle the cotton row during picking. The revolving spindle is designed to remove the cotton from the boll with a minimum of entanglement with the plant. Operation of this type of picker has recently been improved by application of chemical wetting-agent solutions to the spindles—to reduce the amount of moisture transferred from the spindles to the fibers below the amount transferred by former methods, which used large quantities of water alone.

The mechanical stripper in common use operates on a principle whose first application to harvesting was recorded in 1871. The original design was a large boxlike body, or sled, which was pulled along the row so that the cotton plants extended through finger-type projections in front. Modern units have the fingers mounted separately on the side of a tractor, with a built-in conveying system to discharge the cotton into a trailer, which the tractor pulls. The stripper, in contrast to the spindle picker, removes everything from the plant but the upright stalk and heavier branches.

The efficiency of either type of machine is affected by cultural practices. With strippers, varietal characteristics are especially important. Spindle pickers are satisfactory for harvesting a wider range of cotton varieties than

strippers, but because the strippers cost less they tend to be used even where the varieties grown make them unsuitable.

THE COTTON that the farmer brings to the gin continues to belong to him. His acre yield will be calculated from the amount of lint actually ginned. The quality of the baled cotton will determine the price he will receive. During just the few minutes it takes to gin a bale of cotton, the marketable values of the lint can be vitally affected. From the farmer's standpoint, therefore, poor ginning of his crop may nullify any advantages he has had in producing it.

The specific problems in any locality in ginning mechanically harvested cotton arise from many variable factors—regional production, variety of cotton, skill of labor, type of machine used in the harvest, and other conditions that contribute to the market qualities and end uses of the cotton.

An example of variables in regional production: Objectionable growths of grass are seldom found in cotton fields of the Southwest, where varieties of shorter staple length are grown and more mechanical strippers than spindle pickers are employed for harvesting. But in the Central and Southeastern States, where the cottons have somewhat longer fibers and spindle pickers are more popular and feasible, it is more likely that grass will tangle with the fibers and so increase the difficulties of cleaning at the gin.

Many farming practices that affect the efficiency of mechanical harvesting—the cotton variety, the method of picking—correspondingly affect the efficiency of ginning. The manner of transporting and the nature of storage before ginning also make special demands upon ginning facilities.

The purpose of ginning was once only to separate the seeds from the cotton fibers, but the process has been expanded through the years to include the service of improving the quality of the ginned lint. More recently, additional cleaning steps have been introduced to meet the requirements of mechanically harvested cottons.

Gin operations today begin with storage of seed cotton, when necessary, on the premises or at the gin. Thereafter they proceed in this order: Drying the seed cotton; screening out the smaller particles of trash; extracting pieces of foreign matter too large to be screened out (sticks, stems, leaves, and hulls); feeding the cotton into individual gin stands; the ginning proper (separating the fiber from the seed by the saws); conveying the fibers by air to the press box; and, finally, packaging, or baling, the fiber. The ginned seed is usually conveyed to a seed-storage house or returned directly to the farmer's wagon or truck.

A recent development to which the Department's Cotton Ginning Laboratory has contributed is a lint-cleaning process introduced between the gin stand and the press condenser. As much as half a grade in quality has been gained by the extra cleaning at this point. Several ginning-machinery manufacturers now sell lint cleaners to cotton gins, and more than 2.5 million bales have been handled to date through them, seasons 1948–49–50.

Bulk storing of seed cotton on farms or at gins is particularly necessary in mechanical harvesting, where the speed of gathering exceeds that of ginning. Older forms of storage seldom benefit cotton after a week, especially moist cottons from mechanical harvestings. The Department is conducting research to develop better methods of handling mechanically harvested cottons in storage, with the thought that the storage period may be turned into an asset for the industry.

A new system under study is based on drying and cleaning the seed cotton before storage, and then, if necessary, drawing air through a series of bins in which the cotton is stored. With this arrangement, the cotton can be processed and aerated on its way in or out of storage or after it is in the bins.

More than a problem in storage of seed cotton, excessive moisture hinders

cleaning and ginning, for it impedes the removal of foreign matter and causes rough preparation and fiber damage by the gin stands. A moisture content in fiber of 5 percent or below for cleaning and 7 to 10 percent for ginning is desired. To accomplish that, the Department's drying process has been adopted almost universally. Basically, it consists of conveying the seed cotton pneumatically through a vertical drier in which heated air travels about twice as fast as the cotton. The blast of hot air dries out and fluffs the cotton. For cotton that requires drying, air temperatures as high as 260° F. have not seriously affected the fiber or yarn strength, but the fibers have shortened somewhat. Loss in length may ultimately be regained through restoration of moisture at the gin or during after-ginning storage of the baled cotton, but generally the farmer will have been penalized unless approved drying processes are used, because his cotton usually is sold soon after it leaves the gin.

The developments indicate that although the cotton ginner is progressively solving some of the new problems introduced by machine picking, further improvements in gin processes are needed to handle the more trash-filled and moister cotton if the farmer is to derive full benefit from the many advantages of machine harvesting.

THE COTTON TEXTILE INDUSTRY, on its part, too, has watched with interest the rapidly expanding use of mechanical methods of harvesting cotton. The industry is interested in evaluating the problems it will face in processing the cottons. But the coming of mechanization to cotton farms is so recent that research workers have done little more than try to determine the scope of the problems the new development will bring.

Mechanically stripped cotton that has been ginned at plants in the High Plains of Texas with adequate cleaning equipment does not give undue trouble in the textile mill, but only a few gins elsewhere are equipped to handle stripped cotton. Inadequately cleaned cotton has an excess of fine leaf material, referred to as pepper trash, that requires rather severe handling before spinning.

The situation with respect to spindle-picked cotton is somewhat different, for most of the large gins are now equipped to clean it properly.

In 1945–46, the spindle-picked lint cotton seen by mill buyers frequently had roped and twisted masses of fiber and green stains from plant juices. Even with the more modern practice of defoliation before spindle picking, some green leaf may remain to tangle in the fiber. Its removal is almost impossible without excessive loss of lint. Mills have also complained of a peculiar dull cast in spindle-picked cotton that they attribute to fine dust and trash particles, to overdrying of the seed cotton during ginning, or to insect infestation.

The Department of Agriculture and individual mills have investigated the difficulties to be anticipated. The investigators used cottons of medium staple lengths, with an average difference of one grade between paired samples from hand-picked and spindle-picked bales. They found that the latter had about 15 percent more picker and card waste, 3 to 13 percent more neps, somewhat less spinning efficiency (based on ends down per 1,000 spindle hours of operation), and slightly inferior yarn appearance. On the other hand, the yarn strength of the machine-picked lint was slightly higher. Evidently trash and moisture contents are higher in spindle pickings.

The textile mills, of course, cannot economically use mechanically harvested cottons if they cost more to process than hand-picked cottons. And, should the mills become prejudiced against mechanical harvesting, the trend may be toward planting the shorter-staple varieties, which can be cleaned more easily. The farmer, ginner, and textile manufacturer want to avoid those difficulties.

One hopeful approach to a solution lies in the development of machines that are specifically designed for cleaning mechanically picked cottons and that can be used in the production line with existing mill cleaning equipment. The Department's research on how to obtain best results with machine-picked cottons at the textile mill has therefore included the development of new and improved cleaners. The significance of improvements in cleaning during the initial steps of manufacture is obvious to anyone who realizes that in the manufacture of textiles nothing is added to the raw material from the opening of the bale through the woven fabric, except starch sizing, which is applied to help the yarn through the weaving process. Any improvement in the first stages of processing is cumulative through subsequent stages.

A machine developed at the Southern Regional Research Laboratory for opening and fluffing up the lint from bales of mechanically harvested cotton—to put it in the best condition for cleaning—is representative of the type of new machinery needed for the manufacture of quality products from machine-picked cotton.

The opener, a simple machine, consists essentially of several steel-toothed cylinders mounted one above the other. The lint cotton is fed on a flat conveyor belt into the machine, where it forms a rapidly revolving soft roll between flat metal sides. Small tufts of cotton are pulled out of the roll by the cylinder teeth and are removed on the rear side by revolving brushes. The cylinders reject hard objects, such as bale tie buckles. The opener separates the large masses of cotton into finely divided tufts, similar to the lint before it was densely packed in the bale at the gin. The fluffiness of the open cotton permits more adequate cleaning in the usual processes that follow.

The new opener causes no damage to the fibers, even when the same lot of cotton is passed through it several times. Careful measurements of the length of lint cotton processed through conventional textile opening and picking machinery showed the cotton from the finisher lap had a classer's length of 1.05 inches, an average length of 0.87 inch, and a variability of 28.5 percent. The same cotton put through the new opener and then through the same standard processes showed results of 1.05 inches, 0.87 inch, and 28.4 percent, respectively.

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ORIGINALLY DOCK MEANT anything cut off, such as a tail. Later came the current word dockage, meaning something not wanted or useless. Weed seeds, other grains, sand, cinders, ashes, stones, cobs, hulls, pieces of metal, rodent excreta, pieces of insects, and moisture account for the dockage of grains. Dockage, therefore, is a word associated with poor quality. The dry matter or dry substances give grain its real value industrially and on the farm. Discounts for grades of grains are applied because dockage reduces the amount of usable material. Industry, like an animal on the farm, has a bad time trying to make something out of the dockage.—*Robert L. Zipf, Northern Regional Research Laboratory.*